

# UMM QASR WATER SCHEME, IRAQ

**PROJECT NUMBER SIGIR-PA-05-028**

**JULY 24, 2006**

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## **SPECIAL INSPECTOR GENERAL FOR IRAQ RECONSTRUCTION**

July 24, 2006

MEMORANDUM FOR COMMANDING GENERAL, MULTI-NATIONAL FORCES -  
IRAQ  
COMMANDING GENERAL, GULF REGION DIVISION,  
U.S. ARMY CORPS OF ENGINEERS  
DIRECTOR, IRAQ RECONSTRUCTION MANAGEMENT  
OFFICE

SUBJECT: Report on Project Assessment of the Umm Qasr Water Scheme, Iraq (Report  
Number SIGIR-PA-05-028)

We are providing this project assessment report for your information and use. We assessed the construction work and capacity building being performed for the Umm Qasr Water Scheme, Iraq to determine its status and whether intended objectives will be achieved. This assessment was made to provide you and other interested parties with real-time information on a relief and reconstruction project underway and in order to enable appropriate action to be taken, if warranted. The assessment team included a professional engineer and an auditor.

The comments received from the Commander, Gulf Region Division, U.S. Army Corps of Engineers, and the Director, Iraq Reconstruction Management Office, in response to a draft of this report addressed the issues raised. As a result, comments on this final report are not required.

We appreciate the courtesies extended to our staff. This letter does not require a formal response. If you have any questions please contact Mr. Brian Flynn at (703) 604-0969 or [brian.flynn@sigir.mil](mailto:brian.flynn@sigir.mil) or Mr. Andrew Griffith, P.E., at (703) 343-9149 or [andrew.griffith@iraq.centcom.mil](mailto:andrew.griffith@iraq.centcom.mil).

Stuart W. Bowen, Jr.  
Inspector General

# **Special Inspector General for Iraq Reconstruction**

**SIGIR-PA-05-028**

**July 24, 2006**

## **Umm Qasr Water Scheme, Iraq**

### **Synopsis**

**Introduction.** This project assessment was initiated as part of our continuing assessments of selected sector reconstruction activities for Public Works and Water. The overall objectives were to determine whether selected sector reconstruction contractors were complying with the terms of their contracts or task orders and to evaluate the effectiveness of the monitoring and controls exercised by administrative quality assurance and contract officers. We conducted this project assessment in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency. The assessment team included a professional engineer and an auditor.

**Project Assessment Objectives.** The objective of this project assessment was to provide real-time relief and reconstruction project information to interested parties in order to enable appropriate action, when warranted. Specifically, we determined whether:

1. Project results were consistent with original objectives;
2. Project components were adequately designed prior to construction or installation;
3. Construction or rehabilitation met the standards of the design;
4. The Contractor's Quality Control plan and the U.S. Government's Quality Assurance program were adequate; and
5. Project sustainability was addressed.

**Conclusions.** The assessment determined that:

1. The initial objectives of the project were to provide immediate repairs to the existing Sweetwater Canal, provide permanent power supply to Pump Station #2, develop the capability of local Iraqi Ministry staff to take responsibility for canal maintenance, and to develop and implement part of the intermediate term solution (defined as a ten year period) for the canal. Due to substantial de-scoping of the project, permanent power supply to Pump Station #2 was not completed (design only) and the implementation of the intermediate solution was de-scoped to a geotechnical survey of the 20 km section of deteriorated canal. In addition, although substantial equipment and training was supplied to the Ministry of Water Resources personnel, no evidence of maintenance activities was observed. The original objectives and also the de-scoped objectives do not appear to have been met.
2. The contractor submitted design and specifications for the Sweetwater Canal liner repair, drilling and subsurface investigation (geotechnical study), and power for Pump Station #2. The Sweetwater Canal liner repair submittal included specification for the repair of the sidewalls and fabrication and installation of the concrete liners. Permanent power supply for Pump Station #2 submittals included design and specifications for the medium voltage switchgear, high voltage circuit breakers, 132/33 kilovolt mobile substation, insulators, and main transformers.

The drilling and subsurface investigation included specifications for drilling and sampling methodology to determine subsurface conditions of the deteriorating section of the canal. The submittals were reviewed and appear adequate to accomplish the limited construction activities completed through this contract. Although the purchase and installation of the permanent power supply for Pump Station #2 was de-scoped from the task order, the design and specifications can be used for future construction activities.

3. All work observed appeared to be consistent with the intent of the project. The field work portion of this project was completed prior to the site assessment, therefore verification of the emergency repairs of the canal was based on quality control reports and photo logs. Although the canal shows signs of continued deterioration, this could be attributed to the lack of ongoing maintenance of the canal.
4. The contractor submitted a quality management plan that contained the required organization chart, security plan, safety plan, and quality control plan. We determined that the contractor's quality management plan met the standards addressed in Engineering Regulation 1180-1-6 (*Construction Quality Management*) or Project and Contracting Office Standard Operating Procedure Construction Number-103 (*Contractor Construction Quality Control Plan*). The contractor submitted daily quality control reports but we could not locate the contractor's deficiency logs to document problems noted with construction/renovation activities.

The United States Army Corps of Engineers, Engineering Regulation 1110-1-12 and the Project and Contracting Office Standard Operating Procedure Construction Number-100 specify requirements for a government quality assurance program. The Iraqi National quality assurance representative was on site on a regular basis during construction, monitored field activities, and submitted quality assurance reports. A quality assurance deficiency log could not be located for the Umm Qasr Water Scheme project. Overall, the quality assurance program was adequate.

5. The Umm Qasr Water Scheme contract specifications required the contractor to provide the following: operations and maintenance manuals, preventive maintenance plans, proper training, and provide and certify warranties in the name of the appropriate Ministry. The Ministry of Water Resources received heavy equipment, and the contractor provided training for the emergency repair procedures of the canal. The heavy equipment included: the Nissan Bus W41, the generators, and the fuel tanker truck. The heavy equipment and the training received by the Ministry of Water Resources were provided to allow the Ministry to be able to perform emergency canal repairs and to perform routine maintenance on the canal. During the site visit, the assessment team did not see any routine maintenance being performed nor did we see that any emergency repairs had been performed. A principal part of the contract was to perform capacity building so that the Ministry of Water Resources had the equipment and training to perform ongoing maintenance of the canal. Although substantial equipment and training were supplied, it was not apparent that maintenance activities were being accomplished.

**Recommendations.** The Iraq Reconstruction Management Office should determine which Iraqi Ministry is responsible for maintaining the Umm Qasr Water Canal, and why

the equipment provided for maintaining the Umm Qasr Water Canal is not being used to maintain the canal.

**Management Comments.** The Commander, Gulf Region Division (GRD), of the U.S. Army Corps of Engineers and the Director, Iraq Reconstruction Management Office (IRMO) provided comments to the draft report. The Commander GRD “generally” concurred with the conclusions and the draft report discussions, although stated the objective “to provide immediate repairs to the existing Sweetwater Canal” were met because canal failures were significantly reduced, allowing for flow rates above 5 cubic feet per second, up from 1 to 2 cubic feet per second. Although the Commander GRD stated the objectives had been met, he also acknowledged that “continued improvements in the Ministry capability are certainly required”. In addition, the training program was completed to the satisfaction of the Iraqi Ministry of Water Resources (MWR), the MWR had successfully completed an emergency repair of a canal breach in December, 2005, and MWR is currently accumulating clay material for repair at the troubled section of the canal. The Commander GRD did not respond to the recommendation, as the recommendation was addressed to IRMO.

The Director IRMO stated that the de-scoped objectives of the project have been substantially accomplished. IRMO comments mirrored USACE regarding the increased flow rate of the canal, and the training/capabilities of MWR staff and their current accomplishments. IRMO stated that the repairs of the canal were completed in September 2005; however, it is possible that some sections may now require more work due to normal wear and tear from use. Although IRMO also acknowledged continued improvements in the Ministry capability are required, they stated that the objective to improve the Ministry’s capabilities has been substantially achieved. IRMO also highlighted the fact that the Sweetwater Canal was constructed in the mid-1990s as an intermediate solution and the service life of this Canal is nearing its end and there is a pressing need to implement an alternative water supply scheme. The IRMO director stated that SIGIR’s conclusion that the Ministry of Water Resources is not using the equipment provided for maintaining the Sweetwater Canal was based on a single (one day) site visit to only a portion of the canal. IRMO recommended that in the future, more time in the field and interviews with applicable Iraqi Ministry personnel should be conducted in order to more completely assess projects.

**Evaluation of Management Comments.** The management comments addressed the issues raised in our report. USACE and IRMO stated the project met the objectives, although both agreed that improvements in the Ministry capabilities are required. SIGIR does concur that the interviews with applicable Iraqi Ministry personnel should be conducted, but does not agree that the limited time on site and partial survey of the canal system (73 of 238 kilometers) was insufficient to conclude canal maintenance was not being completed. The canal system is being undercut by erosion and there was no recent maintenance detected. These areas have the potential to develop into catastrophic canal wall failures. SIGIR does agree the capabilities have been increased, but did not see any evidence that the capabilities were being utilized to complete necessary day to day repairs of the section of the canal with the greatest problems, historically. IRMO did not present a plan to ensure that the canal would be adequately maintained in the future and commented that maintenance was the MWR responsibility.

# Table of Contents

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<b>Synopsis</b>	i
<b>Introduction</b>	
Objective of the Project Assessment	1
Pre-Site Assessment Background	1
Contract, Task Order and Costs	1
Project Objective	3
Description of Facility (preconstruction)	4
Scope of Work of the Contract	6
Current Project Design and Specifications	7
<b>Site Assessment</b>	
Work Completed	8
Work in Progress	14
Work Pending	14
<b>Project Quality Management</b>	
Contractor's Quality Control Program	15
Government's Quality Assurance	15
<b>Project Sustainability</b>	16
<b>Conclusions</b>	16
<b>Recommendations</b>	18
<b>Management Comments</b>	18
<b>Evaluation of Management Comments</b>	19
<b>Appendixes</b>	
A. Scope and Methodology	20
B. Acronyms	21
C. Report Distribution	22
D. Project Assessment Team Members	24

# **Introduction**

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## **Objective of the Project Assessment**

The objective of this project assessment was to provide real-time relief and reconstruction project information to interested parties in order to enable appropriate action, when warranted. Specifically, we determined whether:

1. Project results were consistent with original objectives;
2. Project components were adequately designed prior to construction or installation;
3. Construction or rehabilitation met the standards of the design;
4. The Contractor's Quality Control (CQC) plan and the U.S. Government's Quality Assurance (QA) program were adequate; and
5. Sustainability was addressed.

## **Pre-Site Assessment Background**

### **Contract, Task Order, and Costs**

The Basrah/Umm Qasr Water Supply project was completed under Contract W914NS-04-D-0007, dated 11 March 2004, Task Order (TO) 0009, as a design-build indefinite delivery indefinite quantity contract for \$600,000,000. The contract was between the Coalition Provisional Authority and Washington International/Black and Veatch, Boise, Idaho. Contract W914NS-04-D-0007 called for the Public Works/Water sector – nationwide design/build services indefinite delivery indefinite quantity to restore, rebuild, and develop national water resources projects.

There were 14 modifications to the initial contract:

- Modification # P00001, issued 29 April 2004, incorporated the FAR Contract Clause 52.244-5 Competition in Subcontracting into the contract.
- Modification # P00002, issued 17 May 2004, included another address for submittal of invoices.
- Modification # P00003, issued 7 August 2004, reflected a change to the contractor's cage code from 3N7C3 to 3X6H5.
- Modification # P00004, issued 12 October 2004, reflected an administrative change transferring administrative responsibility for task orders issued for this contract to the United States Army Corps of Engineers (USACE) Gulf Region Division (GRD).
- Modification # P00005, issued 26 October 2004, incorporated the subparagraph kidnapping or attempted kidnapping in progress, into Section 00800 – Special Contract Requirements, Paragraph J.
- Modification # P00006, issued 5 November 2004, included the USACE address in the administered by Block 7.
- Modification # P00007, issued 10 February 2005, incorporated the Indemnification of Contracts for a Qualified Anti-Terrorism Technology.
- Modification # P00008, issued 21 March 2005, incorporated the Accelerated Definitization under Section P, Method of Ordering (unilateral and bilateral).



- Modification # P00009, issued 8 February 2005, incorporated Section 252.245-7000 Government Furnished Mapping, Charting, and Geodesy Property.
- Modification # P00010, issued 6 April 2005, incorporated a change to the standards for contract cost reporting, which allows the U. S. Government insight into contractor costs.
- Modification # P00011, issued 29 November 2005, updated and incorporated further information pertaining to the Project Document Deliverables.
- Modification # P00012, issued 23 December 2005, incorporated the requirements for subcontracts and capacity development reporting into the Subcontracting Excellence Program Database in accordance with the Subcontracting Excellence Program Database Standard Operating Procedure PR-127 previously furnished.
- Modification # P00013, issued 28 January 2006, included the authority of Life Support privileges to include Third Country National passport holders and clarify contractual information for the purpose of fulfilling badge requirements throughout the country of Iraq.
- Modification # P00014, issued 15 February 2006, is to exercise contract option period 1 for Contract Line Item Number 0003 and 0004 of the base contract by extending the period of performance by one year from 11 March 2006 to 11 March 2007.

TO 0009, dated 15 September 2004, was a design-build to provide repairs to the existing canal and associated facilities, to develop the capability of the local Iraqi Ministry staff to take responsibility for canal maintenance in the intermediate term, to perform a technical review of long-term engineering alternatives for the canal, and to implement preferred long-term engineering options in Iraq. TO 0009 was for \$10,517,308. The Basrah/Umm Qasr Water Supply Scheme (Sweetwater Canal-SWC) will run from the Garraf River at Shatra via Nasiriyah to Basrah, and the assessment team focused on the Water Supply Scheme located in Basrah, Iraq.

TO 0009 currently contains 12 modifications.

- Modification # P00001, dated 22 October 2004, reduced the total obligated amount from \$10,517,308 by \$10,017,038 to \$500,000. No additional changes were incorporated at that time.
- Modification # P00002, dated 25 October 2004, cancelled Modification # P00001 in its entirety. In addition, the total obligated amount was increased from \$500,000 by \$7,530,208.50 to \$8,030,208.50.
- Modification # P00003, dated 4 November 2004, corrected Modification # P00001, dated 22 October 2004, to Modification # 01. In addition, Modification # P00002, dated 25 October 2004, was corrected to Modification # 02. Finally, Modification # 03 restated the Summary of Changes in Modification # P00002, dated 25 October 2004, by canceling in its entirety Modification # P00001. In addition, Modification # 03 decreased the total obligated amount from \$10,517,308 by \$2,487,099.50 to \$8,030,208.50.
- Modification # P00004, dated 6 February 2005, rescinded Modification # 04 dated 21 December 2004. In addition, Modification # 04 constituted a Notice to Proceed.
- Modification # P00005, dated 15 March 2005, replaced the Notice to Proceed and the Statement of Work in its entirety for Modification # 04, dated 6 February 2005, and included a new Statement of Work and Notice to Proceed.

- Modification # P00006, dated 30 April 2005, increased the amount of funds obligated from \$8,030,028.50 to \$16,060,416.50.
- Modification # P00007, dated 5 July 2005, replaced the original Statement of Work with a revised Statement of Work. In addition, the Not to Exceed value for the contract line item number is \$16,060,416.50.
- Modification # P00008, dated 4 September 2005, de-obligated \$2,000,000 from Task Order 0009. Modification # 8 changed the obligated amount from \$26,077,075 to \$24,077,075 and the Not to Exceed is \$24,077,075.
- Modification # P00009, dated 29 September 2005, cancelled Modification # 8 in its entirety.
- Modification # P00010, dated 21 March 2006, cancelled modifications #8 and #9 in their entirety, and reverting back to Modification #7. The modification clarified the obligated funding level and the not-to-exceed amounts. The total deobligated funding is reduced by \$460,416.50 from \$16,060,416.50 to \$15,600,000.00. The limitation of funds was updated to show that the total sum allotted and available for payment of cost under this contract for contract line item number 0001 is \$15,600,000.00. This total includes the \$481,812 base fee amount for work completed under contract line item number 0001. All other terms and conditions remain unchanged.
- Modification # P00011, dated 21 March 2006, definitized the entire task order as a cost-plus-award-fee. The not to exceed value of the task order was reduced by \$352,169 from \$15,600,000.00 to \$15,247,831. The schedule of supplies and services has changed to the following: estimated cost \$14,020,285; the base cost \$393,759; maximum award fee \$1,185,956; and the total estimated cost-plus-award-fee equaling \$15,600,000. All other terms and conditions remain unchanged.
- Modification # P00012, dated 14 May 2006, Washington International/Black and Veatch JV earned the award fee, during the rating period of 24 September 2005 to 23 March 2006, of \$1,124,642.08 (94.83%) from the available award fee of \$1,185,956. The remaining award fee \$61,313.92 was removed from the total award fee pool, and there will be no more award fees or rating periods for this Task Order.

In addition, the Project and Contracting Office Contracting Officer provided the assessment team with the information that Pump Station #2, previously covered under Task Order 09, has been moved under Contract W914NS-04-D-0007, Task Order 12.

### **Project Objective**

Based on the contract and its modifications, the stated objectives of the Umm Qasr Water Scheme project were that the task order was intended to:

- Provide immediate repairs to the existing Sweetwater Canal
- Provide permanent power supply to Pump Station #2
- Develop the capability of local Iraqi Ministry staff to take responsibility for canal maintenance
- Develop and implement part of the intermediate term solution (defined as a ten year period) for the canal

Additionally a key objective was to make maximum use of contractors, suppliers, craftsmen, and laborers in the specific areas where the work will be executed.

### **Description of the Facility (preconstruction)**

The description of the facility (preconstruction) was based on information obtained from the contract and the USACE project file. In general, the Umm Qasr Canal, also referred to as the Sweetwater Canal (SWC) is a 238-kilometer canal system located in southern Iraq, which transports water from south of the City of Kut to the City of Basrah, whose water source has elevated total dissolved solids salt levels. The canal system has sections of concrete lined and unlined open channels, pumping stations, and crossing points. Locations along the canal are referred to by the distance from the canal's endpoint (i.e. Intake near the city of Kut is km-0 and endpoint near the city of Basrah is km-238). The following is a summary of the canal background, route, and characteristics. The summary is taken directly from the Darrell Flinn Gulf Region South (GRS) "Fact sheet Um Qasr Sweetwater (SWC) Basrah – GRS" dated 4 August 2005. Figure 1, shows the general location map of the SWC. Figure 2, taken from the Fact sheet with modifications, shows the route of the SWC.

*"The Governorate of Al Basrah lies at the very downstream end of Iraq's river system and has an estimated population of about 1.8 million. This figure is expected to reach 3.4 million by 2025. Basrah is the second largest city in Iraq and has historically had water supply problems for decades. The urban areas of Basrah obtained their water from the Shatt Al Arab; however, due to Total Dissolved Solids (TDS) levels exceeding 2000 mg/liter and an increase in contamination levels, an alternate source of water had to be found. This new source was the Gharraf River, a tributary of the Tigris and is considerably upstream, but with quite a lot lower TDS levels, made it a better, viable alternative.*

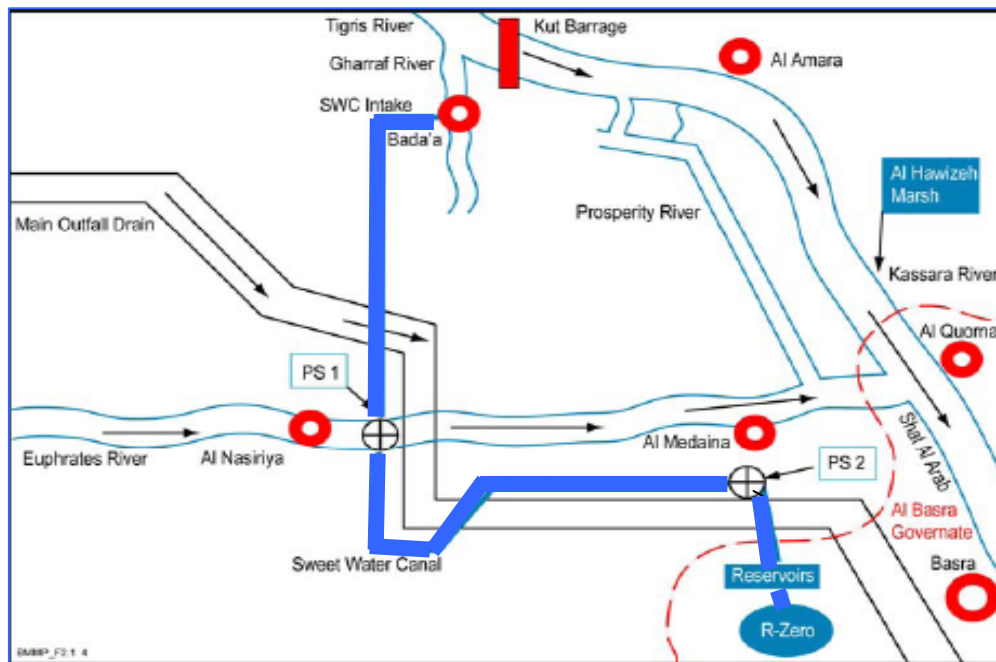
*In the 1990's a 238 km canal, the Sweetwater Canal (SWC), was constructed to bring this new source of water to Basra. This untreated water flowed to a point just west of R Zero in Basra. R Zero is the largest water treatment facility in Basra, just south of the Basra International Airport. Some of this water was treated at R Zero, however, most of it is piped to the intakes of other existing plants in Basra and other cities in the governorate where it replaced the water formerly drawn from the Schatt Al Arab or the adjacent stretches of the Tigris River. Water treatment in the Basra Province utilizes the coagulation-filtration process which will remove organics and bacteria but not sodium. The SWC provides water for a total of 2.5 million people in the Governorates of Basrah and Thi Qar.*

*At the time the SWC was constructed due to a lack of funds and suitable construction materials, the canal was built partially (40%) unlined and structurally unstable. Since its completion, it has experienced problems with leakage, bank collapse, breaches, and other structural issues. These have caused a continuous problem with delivering enough water to R Zero. Compounding this problem is the fact that the Marshes northwest of Basra were completely drained. The actual route of the SWC passes through these former marsh areas. This draining of the marshes removed the filtering effect of plant life and allowed sodium in the form of calcium, potassium and, sodium chlorides to mix into the SWC source water, thus raising the levels of TDS in the SWC as well.*

*This man-made canal runs 238 Km from the Bad'a Regulator 65 km North of An Nasiriyah on the Gharraf River and runs all the way to west of Basra at R Zero to 2 sedimentation/ reservoirs. It was originally designed to be fully concrete lined and to be capable of delivering 13.1 cubic meters/second to R- Zero. In reality, only 60% of this canal is cement lined, or 144 Km, which leaves 40% unlined and clay based. To compound this problem, a major shift in the construction to avoid a high gypsum area was made between Km 86 and Km 165. The depth of the canal in the two lined sections are 3.3meters, the bottom width is 1.5m to 7 meters, with a side slope of 1.5 meter horizontal to 1 meter vertical. This created additional problems, by crossing the Main Outfall Drain also called the Sadaam River (a manmade canal used to drain the marshes) twice; the SWC is subjected to further contamination by the Al Hammar Marsh. This marsh has 94% of its original cover transformed into bare land and salt crusts. This canal is a complex system of open channel and 195 structures including two major pump stations PS1 and PS2 at Km (61.5 and 165.5 respectively), siphons, bridges, crossings, culverts, escapes, etc. it also includes 2 total 750,000 cubic meter storage tanks each located at Km 227, after which 2 canals branch off to feed the main pumping station at R Zero. (Only one canal is being used, this is a lined canal capable of 7.5 cubic meters per second, the other is not completed). The system was constructed under difficult conditions with limited resources, which resulted in a system with major operational and environmental problems. The main problematic area contains a lined and unlined section which runs from Km 165.5 to Km 194.”*



**Figure 1. General location map of the Sweetwater Canal**



**Figure 2. Sweetwater Canal**

### **Scope of Work of the Contract**

Based on the contract and modifications, the major tasks for the Umm Qasr Water Scheme included:

- Immediate and ongoing repair to the canal to prevent failures
- Provision of a permanent power supply to Pump Station #2, (It was reported that this line item was changed to a design of a permanent power supply to Pump Station #2 and that installation of components for a permanent supply would be accomplished under a different task order)
- Development of a plan to transfer, repair, and maintain the canal for the local Ministry staff
- Development and implementation of the intermediate term (10 year solution) for operation and maintenance of the canal. This requirement was reduced in scope to the completion of a geotechnical study of the 20 km deteriorated canal section

In addition to the Umm Qasr water scheme project, U.S. Agency for International Development contracted with Bechtel in 2004 to complete an engineering assessment of the entire canal system, repair pumping stations, and complete emergency repairs of the SWC. Under a separate non-construction project, PCO purchased and supplied approximately 30 vehicles and heavy equipment for transfer to the Iraqi Ministry of Water Resources (MWR) for the purpose of maintaining the canal system. Site Photo 1 shows an example of the type of haul truck purchased and transferred to the MWR.



**Site Photo 1. Haul truck purchased through PCO (Photo courtesy of USACE)**

### **Current Project Design and Specifications**

The Umm Qasr Water Scheme project included construction and non-construction components. The non-construction activities included a geotechnical study of sections of the SWC, design of the permanent power supply for Pump Station #2, and development of a plan to transfer repair and maintenance of the canal to the MWR. Construction activities included the repair of the 20 km stretch which was in most need of repair.

The contract required 30%, 60%, and final design for construction activities, performance specifications for new equipment and materials, as-built drawings, and catalog cuts of major equipment items. The contractor submitted design and specifications for the sweet water canal liner repair, drilling and subsurface investigation (geotechnical study) and power for Pump Station #2.

The Sweetwater canal liner repair submittal included specification for the repair of the sidewalls and fabrication and installation of the concrete liners. Permanent power supply for Pump Station #2 submittals included design and specifications for the Medium Voltage Switchgear, High Voltage Circuit Breakers, 132/33 kilovolt mobile substation, insulators and main transformers. The drilling and subsurface investigation included specifications for drilling and sampling methodology to determine subsurface conditions of the deteriorating section of the canal.

The submittals were reviewed and appear adequate to complete the limited construction activities completed through this contract. Although the purchase and installation of the permanent power supply for Pump Station #2 was de-scoped from the task order, the design and specifications can be used for future construction activities.

## **Site Assessment**

On 24 February 2006, we performed an on-site assessment of sections of the Umm Qasr Canal Water Scheme project. The entire length of the canal was reported to be 238 km long and included intake structures, two pumping stations, and settling basins at the termination point. During the site assessment, the canal section from Pump Station #2 (km 165) to the settling basins (km 238), which is 73 km of the total 238 km long canal system, was viewed. The sections assessed included lined and un-lined sections of the canal, and the 20 km section where emergency repair work was conducted.

The project was listed as 98% complete at the time of the assessment. All fieldwork was reported to be complete and no fieldwork or contractor personnel were observed at the project location. The USACE Basrah Area Engineer and Project Engineer accompanied the assessment team during the site visit.

### **Work Completed**

All field work was reported completed at the time of the site assessment. Pump Station #2, lined sections of the canal to include areas of the emergency repairs, unlined sections of the canal, and the settling basins located at the end of the SWC were visited and will be presented in this section.

### **Pump Station #2**

Pump Station # 2 is located at km mark 165 of the Sweetwater Canal. The contract and modification required the design and installation of permanent power to the facility. The installation of the permanent power is currently being deleted from the task order. Currently Pump Station #2 utilizes electric pumps operating with electricity produced by on-site generators and also diesel powered pumps. The contract required emergency repairs which included maintenance of pumps and repair of generators and diesel engines for the diesel driven pumps. The site assessment team visited the outflow of Pump Station #2. Access to Pump Station #2 was not feasible because it was located on the far side of the river from the outflow, with no assessable crossing point. At the time of the assessment, three of the three outflows from Pump Station #2 to the Sweetwater Canal were pumping water. Site Photo 2 shows the exterior of the Pump Station #2 and Site Photo 3 shows an example of the pumps located within Pump Station #2 (photo courtesy of USACE). Site Photo 4 shows the three outfalls of Pump Station #2 pumping water into the Sweetwater Canal system.





**Site Photo 2. Pump Station #2**



**Site Photo 3. Pumps located at Pump Station #2 (Photo courtesy of USACE)**





**Site Photo 4. Water flowing out of all three pipelines from Pump Station #2 into the Sweetwater Canal**

#### Lined Portion of Canal

The 27 km lined portion of the SWC we were able to visit was located between Pump Station #2 at km marker 165 and km marker 193, where the lined section converts to an unlined section.

During the site visit, the entire 27 km stretch was visited. Numerous areas along the 27 km stretch of lined canal were observed in need of additional repair. Maintenance equipment, maintenance staff, or signs of recent maintenance activities were not observed at the time of the assessment. The canal sidewalls showed signs of being undercut by soil erosion at several locations, causing large voids in the embankments. Numerous areas of concrete liners were observed to be missing, damaged, or improperly repaired.

Site Photo 5 shows an example of the SWC with undamaged embankment and concrete liners. Site Photos 6 through 9 show examples of areas along the lined section of the canal where repairs and maintenance are required. Site Photo 10 shows an area where native rock instead of concrete panels was used for repair.



**Site Photo 5. Undamaged section of canal**



**Site Photo 6. Example of concrete liner failure**



**Site Photo 7. Example of under-cutting of canal**



**Site Photo 8. Example of under-cutting of canal**



**Site Photo 9. Example of concrete liner failure**



**Site Photo 10. Repair of concrete liner**

Two locations in the vicinity of km marker 168 and km marker 188 required emergency repairs. The contract included emergency repairs of these sections. The procedures required identification and removal of appropriate borrow material, excavation of the deteriorated canal section to firm soil or rock, and placement of appropriate borrow material in lifts with compaction. The emergency repairs of the lined portion of the canal were completed prior to the site visit. Review of USACE photos of the repairs show heavy equipment removing soil and new soils being hauled in and compacted in place.

During the site assessment, both areas where emergency repairs were completed were visited. The area in the vicinity of km 168 showed signs of recent repair activities of the canal bank. It appeared the concrete liners were repaired with a concrete slurry applied instead of utilizing prefabricated concrete tiles. The concrete liners were not completely intact and several areas along the canal back showed signs of being undercut by soil erosion, causing large voids in the embankments. Similar conditions were observed at the area in the vicinity of km 188 emergency repair with the addition that surface erosion of the side banks were observed. Maintenance equipment, maintenance staff, or signs of recent maintenance activities were not observed at either of the locations.



Site Photos 11 through 14 show the condition of the canal in the vicinity of the km 168 repairs and Site Photos 15 through 17 show the condition of the canal in the vicinity of the km 188 repairs.



**Site Photo 11. km 168 repair area**



**Site Photo 12. Example of under-cutting of canal sidewall in vicinity of km 168**



**Site Photo 13. Example of concrete liner failure at km 168 repair area**



**Site Photo 14. Repair of concrete liner with concrete slurry at km 168 repair area**



**Site Photo 15. km 188 repair area**



**Site Photo 16. Surface erosion of canal banks at km 188 repair area**



**Site Photo 17. Example of under-cutting of canal sidewall in vicinity of km 188**

#### Unlined portion of the SWC and settling basins

The 45 km unlined portion of the SWC we were able to visit was located between km 193 and the settling basins (km 238). Signs of past maintenance activities were observed and included dredge spoils located parallel to the canal route. Dredge spoils included a combination of soils and vegetation. Maintenance equipment, maintenance staff, or signs of recent maintenance activities were not observed at any point of the unlined section of the canal. A single set of tire prints from a heavy equipment vehicle was observed parallel to the canal. The main channel appeared free of vegetation, although vegetation was observed growing on the sides of the canal. The sluice gates which control water from the SWC to the settling basins and the settling basins themselves appeared serviceable.

Site Photo 18 shows an example of the unlined section of the SWC, Site Photo 19 shows recent tire prints from a heavy equipment vehicle, and Site Photo 20 shows dredge spoils located parallel to the canal. Site Photo 21 shows sluice gates used to control water at the entrance of the settling basin and Site Photo 22 shows the settling basin.



**Site Photo 18. Unlined portion of SWC**



**Site Photo 19. Recent tire tracks from heavy equipment vehicle**



**Site Photo 20. Dredge spoils located parallel to unlined section of SWC**



**Site Photo 21. Slice gates controlling water from SWC to settling basins**



**Site Photo 22. Settling basins**

### **Work in Progress**

At the time of our site visit, work was reported complete; therefore, work in progress was not evaluated.

### **Work Pending**

At the time of our site visit, work was reported complete; therefore, work pending was not evaluated.



## **Project Quality Management**

### **Contractor's Quality Control Program**

The Basrah/Umm Qasr Water Supply contract W914NS-04-D-0007 specified that the contractor was to prepare a contract management plan. The contract management plan was to contain a contract management control system, contract health and safety plan, contract quality management plan, contract security plan, organization chart, key personnel, responsibilities of key personnel, review and sign off procedures, control of work procedures, roles and responsibilities of sub-consultants, roles and responsibilities of subcontracts, key personnel change notifications and procedures, document control procedures, and public relations procedures.

The contractor submitted a quality management plan that contained the required organization chart, security plan, safety plan, and quality control (QC) plan. The quality management plan addressed the QC organization, mobilization, security, material handling and storage. We determined the contractor's quality management plan met the standards addressed in Engineering Regulation 1180-1-6 (*Construction Quality Management*) or PCO Standard Operating Procedure CN-103 (*Contractor Construction Quality Control Plan*).

The contractor submitted daily QC reports, which were reviewed by the USACE Project Engineer and the Quality Assurance Representative (QAR). These reports contained information such as work accomplished each day with the location, activity and by whom, test results, deficiencies and corrective actions, labor distribution, equipment utilized, and material received on site. In addition, the contractor prepared daily inspection checklists for each definable feature that was scheduled to be worked on each day. We could not locate deficiency logs for the Umm Qasr Water Scheme project to document problems noted with construction/renovation activities. However, the QC reports did mention any reoccurring problems that the contractor was experiencing on site.

### **Government Quality Assurance**

Engineering Regulation 1110-1-12 and PCO Standard Operating Procedure CN-100 specify requirements for a Government QA program. The USACE Iraqi National quality assurance representative provided on-site quality assurance. The Iraqi National filed QA reports for the days on site, which were forwarded to the USACE QAR and Resident Engineer for review and verification of progress completed. In addition, the QAR reports were complete and timely. The QA reports contained the work activities performed for the day, the equipment being used, any security concerns that affected the job for the day, any materials received, any inspections performed, and any conflicts or remarks. Furthermore, the QAR reports included project specific and/or detailed photographs that reinforced the information provided in the reports.

PCO CN-102 requirement states that the QAR will maintain a QA deficiency log, which will provide an auditable trail, for all the deficiencies noted during the QA inspections that will include digital photographs of any deficiencies noted. A QA deficiency log could not be located for the Umm Qasr Water Scheme project. The GRD/PCO Sector Lead and Sector Project Manager stated that the QA deficiency logs were completed; however, they were unsure of where the QA deficiency logs were located.

## **Project Sustainability**

The Umm Qasr Water Scheme contract specifications required the contractor to provide the following:

- Operations and maintenance manuals, which shall include standard operating procedures for all equipment and systems, and standard maintenance procedures and recommended spare parts lists for all equipment.
- Preventive maintenance plans, which will provide operating manuals, spare parts lists, and recommended vendor support while the systems are being installed.
- Proper training and capacity strengthening of Iraqi maintenance staff, operational testing, development and uploads of required maintenance job plans, and 90 days of on-call operational oversight and technical assistance in executing the operations and maintenance program.
- Training the Iraqi workforce on the operations and maintenance of the infrastructure facility components. The contractor will provide translation services to communicate or transcribe the training material and project documentation being given to the Iraqi workforce or being turned over to the Iraqi Ministry.
- Provide and certify warranties in the name of the appropriate Ministry, for all equipment, which includes any mechanical, electrical and/or electronic devices, and all operations for twelve months after installation. In addition, the contractor shall provide any other commonly offered extended warranties for equipment and machinery purchased.

The Ministry of Water Resources received heavy equipment, and the contractor provided training for the emergency repair procedures of the canal, the heavy equipment, the Nissan Bus W41, the generators, and the fuel tanker truck. The heavy equipment and the training received by the Ministry of Water Resources was provided to allow the Ministry to be able to perform emergency canal repairs and to perform routine maintenance on the canal. During the site visit, the assessment team did not see any routine maintenance being performed nor did we see that any emergency repairs had been performed. A principal part of the contract was to perform capacity building so that the Ministry of Water Resources had the equipment and training to perform on-going maintenance of the canal. Although substantial equipment and training were supplied, it was not apparent that maintenance activities were being accomplished.

## **Conclusions.**

Based upon the results of our site visit, we reached the following conclusions for assessment objectives 1, 2, 3, 4, and 5. Appendix A provides details pertaining to Scope and Methodology.

### **1. Determine whether project results were consistent with original objectives.**

The project was listed as 98% complete at the time of the site assessment. The initial objectives of the project were to provide immediate repairs to the existing Sweetwater Canal, provide permanent power supply to Pump Station #2, develop the capability of local Iraqi Ministry staff to take responsibility for canal maintenance, and to develop and implement part of the intermediate term solution (defined as a ten year period) for the canal. Due to substantial de-scoping of the project, permanent power supply to Pump Station #2 was not completed (design only) and the

implementation of the intermediate solution was de-scoped to a geotechnical survey of the 20 km section of deteriorated canal. In addition, although substantial equipment and training was supplied to the Ministry of Water Resources personnel, no evidence of maintenance activities was observed. The original objectives and also the de-scoped objectives do not appear to have been met.

2. Determine whether project components were adequately designed prior to construction or installation.

The contractor submitted design and specifications for the Sweetwater Canal liner repair, drilling and subsurface investigation (geotechnical study), and power for Pump Station #2. The Sweetwater Canal liner repair submittal included specification for the repair of the sidewalls and fabrication and installation of the concrete liners. Permanent power supply for Pump Station #2 submittals included design and specifications for the medium voltage switchgear, high voltage circuit Breakers, 132/33 kilovolt mobile substation, insulators, and main transformers. The drilling and subsurface investigation included specifications for drilling and sampling methodology to determine subsurface conditions of the deteriorating section of the canal.

The submittals were reviewed and appear adequate to accomplish the limited construction activities completed through this contract. Although the purchase and installation of the permanent power supply for Pump Station #2 was de-scoped from the task order, the design and specifications can be used for future construction activities.

3. Determine whether construction met the standards of the design.

All work observed appeared to be consistent with the intent of the project. The field work portion of this project was completed prior to the site assessment, therefore verification of the emergency repairs of the canal were based on quality control reports and photo logs. Although the canal shows signs of continued deterioration, this could be attributed to the lack of ongoing maintenance of the canal.

4. Determine whether the Contractor's Quality Control plan and the Government Quality Assurance Program were adequate.

The contractor submitted a quality management plan that contained the required organization chart, security plan, safety plan, and quality control plan. We determined the contractor's quality management plan met the standards addressed in Engineering Regulation 1180-1-6 (*Construction Quality Management*) or PCO Standard Operating Procedure CN-103 (*Contractor Construction Quality Control Plan*). The contractor submitted daily QC reports, which contained information such as work accomplished each day with the location, activity, and by whom, test results, deficiencies and corrective actions, labor distribution, equipment utilized, and material received on site. The contractor did not maintain deficiency logs to document problems noted with construction/renovation activities.

The USACE Engineering Regulation (ER) 1110-1-12 and PCO Standard Operating Procedure CN-100 specify requirements for a Government Quality Assurance program. Overall, the QA program was adequate. The Iraqi National QAR was on site on a regular basis during construction, monitored field activities, and submitted QA reports. A deficiency log was not maintained, but deficiencies were minimal. In



addition, the QA reports included detailed photographs. A QA deficiency log could not be located for the Umm Qasr Water Scheme project.

5. Determine if project sustainability was addressed.

The Umm Qasr Water Scheme contract specifications required the contractor to provide the following: operations and maintenance manuals, preventive maintenance plans, proper training, and provide and certify warranties in the name of the appropriate Ministry.

The Ministry of Water Resources received heavy equipment, and the contractor provided training for the emergency repair procedures of the canal and the heavy equipment; the Nissan Bus W41, the generators, and the fuel tanker truck. The heavy equipment and the training received by the Ministry of Water Resources were provided to allow the Ministry to be able to perform emergency canal repairs and to perform routine maintenance on the canal. During the site visit, the assessment team did not see any routine maintenance being performed nor did we see that any emergency repairs had been performed. A principal part of the contract was to perform capacity building so that the Ministry of Water Resources had the equipment and training to perform ongoing maintenance of the canal. Although substantial equipment and training were supplied, it was not apparent that maintenance activities were being accomplished.

**Recommendations.**

The Iraq Reconstruction Management Office should determine which Iraqi Ministry is responsible for maintaining the Umm Qasr Water Canal, and why the equipment provided for maintaining the Umm Qasr Water Canal is not being used to maintain the canal.

**Management Comments.**

The Commander, Gulf Region Division (GRD), of the U.S. Army Corps of Engineers and the Director, Iraq Reconstruction Management Office (IRMO) provided comments to the draft report. The Commander GRD “generally” concurred with the conclusions and the draft report discussions, although stated the objective “to provide immediate repairs to the existing Sweetwater Canal” were met because canal failures were significantly reduced, allowing for flow rates above 5 cubic feet per second, up from 1 to 2 cubic feet per second. Although the Commander GRD stated the objectives had been met, he also acknowledged that “continued improvements in the Ministry capability are certainly required”. In addition, the training program was completed to the satisfaction of the Iraqi Ministry of Water Resources (MWR), the MWR had successfully completed an emergency repair of a canal breach in December, 2005, and MWR is currently accumulating clay material for repair at the troubled section of the canal. The Commander GRD did not respond to the recommendation, as the recommendation was addressed to IRMO.

The Director IRMO stated that the de-scoped objectives of the project have been substantially accomplished. IRMO comments mirrored USACE regarding the increased flow rate of the canal, and the training/capabilities of MWR staff and their current accomplishments. IRMO stated that the repairs of the canal were completed in September 2005; however, it is possible that some sections may now require more work due to normal wear and tear from use. Although IRMO also acknowledged continued

improvements in the Ministry capability are required, they stated that the objective to improve the Ministry's capabilities has been substantially achieved. IRMO also highlighted the fact that the Sweetwater Canal was constructed in the mid-1990s as an intermediate solution and the service life of this canal is nearing its end and there is a pressing need to implement an alternative water supply scheme. The IRMO director stated that SIGIR's conclusion that the Ministry of Water Resources is not using the equipment provided for maintaining the Sweetwater Canal was based on a single (one day) site visit to only a portion of the canal. IRMO recommended that in the future, more time in the field and interviews with applicable Iraqi Ministry personnel should be conducted in order to more completely assess projects.

### **Evaluation of Management Comments.**

The management comments addressed the issues raised in our report. USACE and IRMO stated the project met the objectives, although both agreed that improvements in the Ministry capabilities are required. SIGIR does concur that the interviews with applicable Iraqi Ministry personnel should be conducted, but does not agree that the limited time on site and partial survey of the canal system (73 of 238 kilometers) was insufficient to conclude canal maintenance was not being completed. The canal system is being undercut by erosion and there was no recent maintenance detected. These areas have the potential to develop into catastrophic canal wall failures. SIGIR does agree the capabilities have been increased, but did not see any evidence that the capabilities were being utilized to complete necessary day to day repairs of the section of the canal with the greatest problems, historically. IRMO did not present a plan to ensure that the canal would be adequately maintained in the future and commented that maintenance was the MWR responsibility.

## **Appendix A. Scope and Methodology**

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We performed this project assessment from February through June 2006, in accordance with the Quality Standards for Inspections issued by the President's Council on Integrity and Efficiency. The assessment team included a professional engineer and an auditor.

In performing this Project Assessment, we:

- Reviewed contract documentation to include the following: Contract, Contract Modifications, Task Order, Task Order Modifications, Contract documentation, and Statement of Work;
- Reviewed the design package (drawings and specifications), Quality Control Plan, Contractor's Quality Control Reports, Training Plans, and Quality Assurance Reports;
- Interviewed the United States Army Corps of Engineers Area Engineer; Washington International Black & Veatch, Director Middle East Operations, Water/Infrastructure; and the Gulf Region Division/Project and Contracting Office Transition Manager, Senior Program Analyst, Implementation Sector Lead, and Sector Project Manager; and
- Conducted an on-site assessment and documented the results at Basrah/Umm Qasr Water Scheme, located in Basrah, Iraq.

## Appendix B. Acronyms

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GRD	Gulf Region Division
km	kilometer
PCO	Project and Contracting Office
QA	Quality Assurance
QC	Quality Control
QAR	Quality Assurance Representative
SWC	Sweetwater Canal
TO	Task Order
USACE	United States Army Corps of Engineers

## **Appendix C. Report Distribution**

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### **Department of State**

Secretary of State

Senior Advisor to the Secretary and Coordinator for Iraq

U.S. Ambassador to Iraq

Director, Iraq Reconstruction Management Office

Inspector General, Department of State

### **Department of Defense**

Deputy Secretary of Defense

Director, Defense Reconstruction Support Office

Under Secretary of Defense (Comptroller)/Chief Financial Officer

Deputy Chief Financial Officer

Deputy Comptroller (Program/Budget)

Inspector General, Department of Defense

### **Department of the Army**

Assistant Secretary of the Army for Acquisition, Logistics, and Technology

Principal Deputy to the Assistant Secretary of the Army for Acquisition,  
Logistics, and Technology

Deputy Assistant Secretary of the Army (Policy and Procurement)

Director, Project and Contracting Office

Commanding General, Joint Contracting Command – Iraq/Afghanistan

Commander, Gulf Region Division, U.S. Army Corps of Engineers

Assistant Secretary of the Army for Financial Management and Comptroller

Auditor General of the Army

### **U.S. Central Command**

Commanding General, Multi-National Force - Iraq

Commanding General, Multi-National Corps – Iraq

Commanding General, Multi-National Security Transition Command – Iraq

Commander, Joint Area Support Group – Central

### **Other Defense Organizations**

Director, Defense Contract Audit Agency

## **Other Federal Government Organizations**

Director, Office of Management and Budget  
Comptroller General of the United States  
Inspector General, Department of the Treasury  
Inspector General, Department of Commerce  
Inspector General, Health and Human Services  
Inspector General, U.S. Agency for International Development

## **Congressional Committees and Subcommittees, Chairman and Ranking Minority Member**

### **U.S. Senate**

Senate Committee on Appropriations  
    Subcommittee on Defense  
    Subcommittee on Foreign Operations  
Senate Committee on Armed Services  
Senate Committee on Foreign Relations  
    Subcommittee on Near Eastern and South Asian Affairs  
    Subcommittee on International Operations and Terrorism  
Senate Committee on Homeland Security and Governmental Affairs  
    Subcommittee on Government Efficiency and Financial Management  
    Subcommittee on Financial Management, the Budget, and International Security

### **U.S. House of Representatives**

House Committee on Appropriations  
    Subcommittee on Defense  
    Subcommittee on Foreign Operations, Export Financing and Related Programs  
House Committee on Armed Services  
House Committee on International Relations  
    Subcommittee on Middle East and Central Asia  
House Committee on Government Reform  
    Subcommittee on Government Efficiency and Financial Management  
    Subcommittee on National Security, Emerging Threats and International Relations

## **Appendix D. Project Assessment Team Members**

The Office of the Assistant Inspector General for Inspections, Office of the Special Inspector General for Iraq Reconstruction, prepared this report. The principal staff members who contributed to the report were:

Michael Stanka, P. E.  
Angelina Johnston